(Unclassified Paper)

NAVAL WAR COLLEGE
Newport, R.I.

COMMAND AND CONTROL IN *JOINT VISION 2010:* MICRO-MANAGEMENT OR DECISION EXPLOITATION?

by

Robert William Cone

Lieutenant Colonel, United States Army

A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College, the Department of the Navy, or the Department of the Army.

Signature: Robert W. Cone

16 May 1998

A. J. Bergstrom

Faculty Advisor
Colonel Al Bergstrom
JMO

REPORT DOCUMENTATION PAGE

1. Report Security Classification: UNCLASSIFIED	
2. Security Classification Authority:	
3. Declassification/Downgrading Schedule:	
4. Distribution/Availability of Report: DISTRIBUTION STATEMENT A: APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED.	
5. Name of Performing Organization: JOINT MILITARY OPERATIONS DEPARTMENT	
6. Office Symbol: C	**7. Address:** NAVAL WAR COLLEGE 686 CUSHING ROAD NEWPORT, RI 02841-1207
8. Title (Include Security Classification): COMMAND AND CONTROL IN JOINT VISION 2010: MICRO-MANAGEMENT OR DECISION EXPLOITATION? (U)	
9. Personal Authors: LTC ROBERT W. CONE, USA	
10. Type of Report: FINAL	**11. Date of Report:** 18 May 1998
12. Page Count: 21	
13. Supplementary Notation: A paper submitted to the Faculty of the NWC in partial satisfaction of the requirements of the JMO Department. The contents of this paper reflect my own personal views and are not necessarily endorsed by the NWC or the Department of the Navy.	
14. Ten key words that relate to your paper: Command and Control, Decision Making, Centralization, Decentralization, JV2010, Information Superiority, Precision Engagement, Dominant Maneuver, Micro-management, Decision Cycles.	

15. Abstract: The purpose of this paper is to examine the relationship between the potential of information superiority, decision-making processes inherent in command and control functions, and the appropriate degree of centralization in organizational decision making in the Joint Vision 2010 environment. This paper develops a framework of analysis to allow future commanders to ensure operational and tactical decisions are made at the level that is appropriate to the effective functioning of the organization. Such prioritization is necessary in order to fully exploit the capabilities of the organization while avoiding information overload at the organization's highest levels. Making decisions at the appropriate level is essential to operating inside the opponent's decision cycle and fully exploiting short-lived opportunities presented by opponents. The challenge for the future commander is to carefully examine the nature of the task to be accomplished and determine the appropriate level of decision making. The consideration of organizational information processing requirements/capabilities, the need for independent action/separate decision cycles, and time as a limitation provide a general framework for assessing an appropriate level of centralization versus decentralization in decision making. The application of this framework on the new operational concepts of precision engagement and dominant maneuver reveal important theoretical contrasts in decision making. Since Joint Vision 2010 envisions a unique combination of these operational concepts together on the battlefield, the future commander must carefully examine situational variables identified in the framework in order to assign command and control decision-making responsibilities at the appropriate level.

16. Distribution / Availability of Abstract:	**Unclassified**	**Same As Rpt**	**DTIC Users**
	X		

17. Abstract Security Classification: UNCLASSIFIED	
18. Name of Responsible Individual: CHAIRMAN, JOINT MILITARY OPERATIONS DEPARTMENT	
19. Telephone: 841-6461	**20. Office Symbol:** C

Abstract of

COMMAND AND CONTROL IN *JOINT VISION 2010*: MICRO-MANAGEMENT OR DECISION EXPLOITATION?

The purpose of this paper is to examine the relationship between the potential of information superiority, decision-making processes inherent in command and control functions, and the appropriate degree of centralization in organizational decision making in the *Joint Vision 2010* environment. This paper develops a framework of analysis to allow future commanders to ensure operational and tactical decisions are made at the level that is appropriate to the effective functioning of the organization. Such prioritization is necessary in order to fully exploit the capabilities of the organization while avoiding information overload at the organization's highest levels. Making decisions at the appropriate organizational level is essential to operating inside the opponent's decision cycle and fully exploiting short-lived opportunities presented by opponents.

The challenge for the future commander is to carefully examine the nature of the task to be accomplished and determine the appropriate level for decision making. The consideration of organizational information processing requirements/capabilities, the need for independent action/separate decision cycles, and time as a limitation provide a general framework for assessing an appropriate level of centralization versus decentralization in decision making. The application of this framework on the new operational concepts of precision engagement and dominant maneuver reveal important theoretical contrasts in decision-making requirements. Since *Joint Vision 2010* envisions a unique combination of the application of these operational concepts together on the battlefield, the future commander must carefully examine the situational variables identified in this framework in order to assign command and control decision-making responsibilities at the appropriate level.

TABLE OF CONTENTS

Introduction.

Joint Vision 2010 provides a conceptual template for the development of the American military into the next century. America's Armed Forces will leverage new technologies focused on achieving dominance across the full spectrum of military operations to achieve unprecedented levels of effectiveness in joint warfighting.[1] A central premise of this vision is the ability of American forces to achieve information superiority over potential adversaries through technological advances in accessing information and improvements in speed and accuracy of prioritizing and transferring data.[2] The promise of information superiority appears to hold its most profound impact in the area of command and control operations, and more specifically, on the processes of decision making within military organizations.

Given the tremendous increase in capabilities offered by information superiority in command and control functions, there is a healthy skepticism in the ranks of serving officers regarding the tendencies these changes will hold for organizational decision making and ultimately, organization effectiveness.[3] Given the degree of political supervision and pressure for results that senior military leaders will face in the future environment, the temptation to centralize decision making will be strong. The crux of the dilemma is captured in *Expanding Joint Vision 2010: Concepts for Future Operations*: "Although the potential will exist to centralize the execution of future joint operations, appropriate decentralization will more fully exploit the capabilities of agile organizations and the initiative of leadership at every level. The future commander must resist the temptation to centralize execution authority when it is not warranted."[4]

The purpose of this paper is to examine the relationship between the potential of information superiority, decision-making processes inherent in command and control functions,

and the appropriate degree of centralization in organizational decision making in the *Joint Vision 2010* environment. My intent is to provide the future commander with a framework of thinking to avoid the temptation to over centralize decision making while seeking the appropriate level to achieve maximum organizational effectiveness. In this way, the future commander may exercise proper restraint and ensure operational and tactical decisions are made at the level that is appropriate to the effective functioning of the organization. Such prioritization is necessary in order to fully exploit the capabilities of the organization while avoiding information overload at the organization's highest levels. The maintenance of decision making at the appropriate organizational level is essential to operating inside the opponent's decision cycle and fully exploiting short-lived opportunities presented by opponents.

Command and Control in Joint Vision 2010.

Command and control is defined as "the exercise of authority and direction by a properly designated commander over assigned forces in the accomplishment of the mission."[5] It is the means by which a Joint Force Commander synchronizes activities in time, space, and purpose to achieve unity of effort. Command and control links together the functions of all levels of war and echelons of command across the full range of military operations.[6] In *Joint Vision 2010*, command and control will ultimately bind new operational concepts together into a single coherent concept to enable the force to conduct decisive operations.[7]

The central feature and purpose of any command and control system must be the ability to make accurate and timely decisions both in planning and executing military operations.[8] Increased information flow alone does not guarantee that the decision-making process will achieve better results. Rather, decision-making processes must take into account the relationship between a number of critical decision-making factors. Factors that must be considered in

decision-making processes are: quantity and type of information available, cognitive processes required to translate raw data to useable forms, the application of knowledge in appropriate decision cycles, and the need to act faster than an adversary can effectively complete his own decision cycle.[9] In order to fully understand the significance of information superiority on command and control decision making, it is first necessary to examine each of these factors and processes as they relate to the *Joint Vision 2010* paradigm.

Available Information.

The enabling concepts of *Joint Vision 2010,* specifically information superiority, will provide commanders with unprecedented quantities of information about the battlefield. Information superiority is formally defined as: "the capability to collect process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same."[10] Such a capability will result in commanders possessing an unprecedented level of situational knowledge about the battlefield. This evolving concept of "battlespace awareness" is achieved through "sensing and reporting technologies and includes both the platforms and sensors we associate with intelligence gathering, surveillance, and reconnaissance -- and reporting systems that provide better awareness of our own forces, from in-transit visibility of logistics flows to the location, activity and status of our units, allied units, and noncombatants."[11]

Information superiority derives its full impact from the use of information networks to exponentially expand the quantity and speed of information dispersal. This capability as represented in the concept of network-centric warfare which promises to deliver a near real-time comprehensive knowledge of the operational and tactical battlespace. This virtually continuous form of situational awareness will provide for "a much faster and more effective style of warfare characterized by the new concepts of speed of command and self-synchronization."[12]

Proponents of information superiority assert that battlefield collection systems are now capable of rapidly translating information about the battlefield into more advanced forms of information for further consumption and use in the cognitive process. These new information forms will expand our concept from simple declarative data forms into more dynamic and predictive information models. For example, "behavioral information" would be capable of representing a three-dimensional simulation that will predict the behavior of physical objects.[13] Such an application could be used in templating enemy movement based upon current location, speed, and direction. Although useful, it is important to note that such predictions are based upon current patterns of activity and do not account for the enemy's higher cognitive processes such as deception and intent.

Although information superiority promises to provide an enhanced medium to gather and share raw information about the battlefield, the ability to analyze that information and process it into a meaningful whole remains a fundamental task of command and control systems. Despite numerous advances in artificial intelligence, the ability to rapidly translate massive quantities of unprocessed information into a formal decision-making process remains fundamentally a human cognitive process.[14]

Cognitive Processing.

In order to fully comprehend the task of applying increased quantities of information into a formal decision-making process, it is necessary to adopt a common paradigm of cognitive processing. Naval Doctrine Publication (NDP) 6, *Naval Command and Control*, and Joint Publication 6-0, "Doctrine for Command, Control, Communications, and Computer (C4) Systems Support to Joint Operations" provide a hierarchical model for comprehending these cognitive processes and their interrelationships.[15]

The first step in the cognitive hierarchy begins with the collection of "raw signals, facts, bits/bytes and inputs" from the vast array of sensors, collectors, reconnaissance, and surveillance assets and the host of other reports provided by our information systems. After collection, this raw information must be processed into a more useable status through the practices of "formatting, filtering, translating, and plotting." At this point, raw "data" has been processed into "information" which can be used in higher cognitive functions.

"Information" must then be translated into "knowledge" through the process of cognition. Cognition correlates, analyzes, fuses, and validates information into higher forms of knowledge which can then be used in processes of learning and judgment. In the tactical and operational setting, we often call this processed information or knowledge "intelligence." "Intelligence is a form of knowledge that helps build a picture of the situation -- as it exists now, and may exist in the future." At the highest levels of cognitive functioning, knowledge or intelligence is further developed through the process of applying "judgment" to "understanding." Understanding is the result of "synthesizing and visualizing" knowledge and intelligence. These judgments are based upon the application of "purely human skill, based on experience, expertise, and intuition." [16]

Command and control systems must be concerned with the application of the full cognitive hierarchy from data collection through the application of judgment and understanding. Clearly, information necessary for decision-making processes is found at the highest level of the cognitive domain. Although information superiority promises to dramatically increase the quantity and quality of available data, our ability to effectively apply that data in a decision-making process remains subject to human processes. This problem is particularly acute when we realize the time constraints imposed upon decision makers in making accurate and relevant decisions.

Decision Cycles.

Within a military context, the entire cognitive hierarchy of information processing takes place within the constraints imposed by the "decision cycle." For the military commander, the decision cycle obviates two irrefutable facts. First, tactical and operational decisions are linked in a cycle of interaction with an opponent or adversary. Decisions achieve relevancy and accuracy based upon the changing circumstances of enemy action and reaction. Second, in order to be successful, decisions must be made in windows of opportunity which allow the friendly force to exploit the specific circumstances at hand. This fact creates tremendous pressure to execute cognitive processes within the decision cycle as rapidly as possible.

The most prevalent model of the military decision cycle is the "OODA loop" attributed to Colonel John R. Boyd, USAF (Ret.).[17] Boyd specifies four major elements of the decision cycle, these are: observe, orient, decide, and act. Roughly linked to the data and information phases of the model of cognitive hierarchy, Boyd specifies that commanders collect data, process information, and form a common tactical picture during the observe step. During the orient step, commanders derive knowledge, apply judgment, and form understanding to decide upon the best courses of action. These steps equate to the knowledge and understanding phases of the cognitive hierarchy model. Next, the commander makes a decision based upon his application of human judgment. This decision is translated into mission, intent, and combat orders. Finally, the decision is executed in the act step while the commander monitors execution while continuing to collect data to begin the process all over again.[18]

As a model, the "OODA loop" effectively represents many of the advantages and vulnerabilities provided by information superiority in the processes and capabilities of tactical and operational decision making. Information superiority holds significant potential in increasing

both the quantity and speed of information available in the "observe" step of the model. The increased capabilities of information age technology hold exceptional potential for improving the quality of tactical and operational decisions, as well as significantly increasing the speed of those decisions. These increased capabilities provide even greater advantage when considered within the context of a competitive, interactive decision-making environment.

At the same time, the OODA model reveals that the higher cognitive functions of the model are still dependent on the human processes of judgment and cognition to execute the command and control function of decision making. This limitation, coupled with the requirement to make decisions faster than an opponent's "OODA loop," requires careful consideration regarding the types of decision to be made and the appropriate level of decision making within the organization.

Implications for *Joint Vision 2010*.

Given this general discussion of information superiority and its relationship to the cognitive processes of command and control decision making, it is apparent that the future commander must balance the limitations of available time and capacity to process information against the tremendous advantages accrued from accumulating seemingly endless quantities of information now available. According to numerous organizational theorists, the decision to centralize or decentralize decision-making processes should be based upon the task to be accomplished.[19] Specifically, the nature of the task at hand generates a number of situational variables that may optimize forms of decision making. In the case of the future military commander, the nature of tasks on the future battlefield are described in the emerging operational concepts provided in *Joint Vision 2010*. It is through a careful examination of these tasks that

we will achieve a better understanding of the parameters that guide future commanders in centralized versus decentralized decision making.

Emerging Operational Concepts.

In order to fully exploit the advantages of modern technology, *Joint Vision 2010* has transformed the traditional functions of strike, maneuver, protection, and logistics into a new conceptual framework. The basis for this framework is achieved through the improved capabilities for command and control, and intelligence provided by information superiority.[20] The new operational concepts are: precision engagement, dominant maneuver, full dimensional protection, and focused logistics. For the purposes of this paper, it is necessary to restrict my analysis of decision-making processes and centralization to the operational concepts most directly related to warfighting: precision engagement and dominant maneuver. However, it is important to note that full dimensional protection and focused logistics yield equally significant observations regarding trends in organizational decision making.

As organizational tasks, precision engagement and dominant maneuver represent fundamentally different requirements which demand varying levels of decision-making authority to fully exploit their capabilities. In order to optimize the level of decision making, we must consider the situational variables attendant in these operational concepts. These are: 1) the extent of information processing requirements necessary to make a decision; 2) the need for independent action represented by separate decision cycles; and 3) the time available to exploit an opponent's decision cycle.

Precision Engagement.

The origins of precision engagement are found in its predecessor, strike. Joint Vision 2010 describes precision engagement as "... a system of systems that enables our forces to locate

the objective target, provide responsive command and control, generate the desired effect, assess our level of success, and retain the flexibility to reengage with precision when required."[21] Essential to this concept is the new system of systems or information network that will be used to link sensors, target information, decision makers, and shooters together to achieve desired effects. The application of new technologies in the form of digitization, computer processing, and global positioning will enable the commander to apply force with a level of speed and accuracy in achieving target effects that is unprecedented in the history of warfare.[22]

The forms of decision making required to exploit the vast capabilities of precision engagement require a high degree of centralization. This conclusion is supported by an analysis of the three situational variables described earlier. Overall, precision engagement requires a low level of sophisticated information processing, a lack of independent action or need to respond to separate enemy decision cycles, and a minimization of time as a limitation in decision making.

Information Processing Requirement/Capabilities.

First, the overall requirement for higher forms of information processing in precision engagement is relatively low. Precision engagement is fundamentally a targeting process which involves accumulating and processing data to locate, identify, and track specified targets for destruction. Information processes typically would not include the higher cognitive functions of determining enemy intent or coping with deception efforts. Rather, precision engagement presumes a level of superiority in situational awareness and applying force which make a detailed assessment of enemy intentions or operational scheme virtually irrelevant.

Second, the technology currently available is well suited to the requirements of displaying vast quantities of relatively low level information forms. Such information can be easily

represented in the form of detailed video images that enhance situational awareness and display information necessary for the targeting process.

Independent Action/Separate Decision Cycles.

Precision engagement presumes little need for subordinate elements to engage in independent action against enemy forces. Rather, the strength of a systems approach derives from the synergistic capabilities of a broad range of sensors and shooters acting in a coordinated manner.[23] Although weapon systems are not prohibited from acting independently in matters such as self defense or exploiting opportunities presented by an enemy force, the system of systems achieves its most powerful effects by acting within a concerted network.

The application of precision engagement would imply the functioning of a single "OODA loop" oriented on the enemy's capabilities taken as an aggregate. The vast capabilities of information systems to operate within an opponent's decision cycle would therefore be a function of the overlap of Battlespace Awareness, Advanced C4I, and Precision Force Use applied across the entire battle area.[24] Conceptually, our ability to develop a near perfect knowledge of the battlespace coupled with our ability to act unilaterally in targeting and destroying enemy forces would preclude our need to identify and act within subordinate enemy "OODA loops."

Time as a Limitation.

The factor of time as a constraint in the decision-making process is minimized by the comprehensive and near simultaneous presentation of data made available within the implementing technologies of precision engagement. Since the decision-making process is essentially limited to the procedure of identifying targets and handing them off to appropriate resources for the precision application of force, the problem of making decisions within a time frame of an opponent's decision cycle is minimized.

Decision Making in Precision Engagement.

Overall, the decision-making processes required within precision engagement are ideally suited to centralization. Precision engagement promises the Joint Task Force Commander the capabilities to achieve near perfect information about the identity and location of enemy forces within his battlespace. Precision engagement gains its considerable strength by linking the broad array of sensing and shooting platforms into a network or system. Therefore, centralized decision making is best suited to fully exploiting and allocating the resources of that system.

Dominant Maneuver.

Joint Vision 2010 describes dominant maneuver as "...the multidemensional application of information, engagement, and mobility capabilities to position and employ widely dispersed joint air, sea, land and space forces to accomplish the assigned operational task."[25] Dominant maneuver derives from the current doctrinal concept of maneuver which seeks to achieve a position of relative advantage through movement in combination with fire in order to accomplish the mission. Dominant maneuver will achieve its objectives "through a combination of asymmetric leverage, achieved by our positional advantages, as well as decisive speed and tempo, dominant maneuver allows us to apply decisive force to attack enemy centers of gravity at all levels of war and compels adversary to either react from a position of disadvantage or quit."[26]

Dominant maneuver's key elements hold important implications for command and control decision making. First, the achievement of a positional advantage over a potential adversary is based upon the massing of weapon effects from a broad array of air, land, sea, and space capabilities. These effects are directed against enemy decisive points and centers of gravity. This

implies an interactive and dynamic application of force based on rapidly changing battlefield conditions. Second, in order to take advantage of these rapidly changing battlefield condition and achieve massed weapons effects from broadly dispersed forces, command and control systems must achieve unprecedented levels of effectiveness.[27] *Joint Vision 2010* posits that attainment of information superiority will provide these improved command and control capabilities to the Joint Force Commander.

In order to achieve its specified objectives, the prevalent mode of decision making in dominant maneuver must be decentralization. Clearly, it is only through the aggressive actions of subordinate commanders operating independently to exploit enemy vulnerabilities that the effects of dominant maneuver can be achieved. This conclusion is supported by a detailed analysis of the situational variables of decision making.

Information Processing Requirement/Capabilities.

Dominant maneuver requires an extremely high level of information processing in order to achieve desired results. Beyond the application of simple forms of data and information about an adversary, dominant maneuver demands the application of higher cognitive processes for determining enemy patterns of operation, intent, and possible deception. Such analysis is essential to correctly identifying enemy decisive points and centers of gravity. Stated in more direct terms, simple knowledge of enemy locations and rates of movement may provide sufficient information for a targeting process; however, such knowledge is only the basis for the analytical processes necessary to apply operational art.

Although automated decision aides provide some promise in assisting in data processing, the potential for significant information overload is strong. Based upon information processing requirements alone, no single command and control node is capable of making decisions at the

operational and tactical levels with the speed and accuracy necessary to sustain the tempo of operations required under the dominant maneuver paradigm. Such limitations in information processing capabilities argue strongly for processing information and making decisions at a number of subordinate command and control nodes that can take full advantage of the situation at hand.

Independent Action/Separate Decision Cycles.

Dominant maneuver will require the application of a number of separate "OODA loops" in order to fully exploit opportunities against an adversary. Since dominant maneuver seeks to achieve decisive operations simultaneously throughout the entire battlespace, a wide variety of maneuver units and delivery systems must be employed. Each of these sub-elements must act to exploit opportunities consistent with their full capabilities in order to overload the adversaries command and control, and decision-making capabilities. The cumulative effect of dominant maneuver is a hierarchy of dynamic, thinking organizations seeking to exploit battlefield opportunities while sharing a highly resolved, common vision of their battlespace.

Time as a Limitation.

The factor of time is critical in attempting to overwhelm and overload an opponent's capabilities. Making command and control decisions more rapidly than a opponent, or within the opponent's decision cycle, can effectively foreclose or "lock-out" an adversary's options.[28] This ability to virtually paralyze and opponent through speed and tempo of operations places increased emphasis on the speed of command and control decision making. Dominant maneuver seeks to exploit the capabilities and promise of information superiority to assist in achieving that end.

Decision Making in Dominant Maneuver.

The interaction of the factors of information capacity, separate decision cycles, and time restrictions reveal important tendencies in command and control decision making in the dominant maneuver paradigm. The lack of capability to perform the highest levels of cognitive processing clearly supports delegating decision-making responsibilities to lower echelons of command. This delegation process avoids the potential pitfalls of information overload and the concomitant delays in the time required to make decisions. In addition to the advantages provided in speed, the delegation process provides additional opportunities for independent action through the execution of multiple "OODA loops." The net effect is a strong trend toward decentralization in command and control decision-making which creates an "evolutionary division of labor" among subordinate headquarters elements.[29]

Conclusion.

Admiral William A. Owens, former Vice Chairman of the Joint Chiefs of Staff, is quoted as having described enhancements in global intelligence systems combined with enhancements in C4I as having the potential to lift the fog of war by providing "real-time surveillance of a 200-mile-wide-battlefield."[30] To illustrate the implications of this new capability, he used the analogy of a game of chess in which one side would possess the capability, through information superiority, to clearly see the entire chess board. In regard to the subject of command and control decision making, this analogy is extremely instructive in what it says, and what it does not say about the promise of information superiority.

Despite perfect knowledge of the location of the opponent's pieces, the game of chess itself remains the challenge. Very much like war, a chess match is about thinking, assessing an

opponent's intentions, and acting to exploit opportunities. Lifting the fog of war greatly clarifies the situation; however, the challenge of the game itself remains.

The advent of information superiority will provide a tremendous increases in accurate, comprehensive and timely information about the modern battlefield. Although this information will generate unprecedented levels of situational awareness, it is not alone a substitute for a command and control decision-making process. Higher levels of cognitive processing remain a fundamentally human process.

The challenge for the future commander is to carefully examine the nature of the task to be accomplished and determine the appropriate level for decision making. The consideration of organizational information processing capabilities, the need for independent action/separate decision cycles, and time as a limitation provide a general framework for assessing an appropriate level of centralization versus decentralization in decision making. Clearly, the new operational concepts of precision engagement and dominant maneuver highlight important theoretical contrasts in decision-making requirements. Since *Joint Vision 2010* envisions a unique combination of the application of these operational concepts together on the battlefield, the future commander must carefully examine situational variables in order to assign command and control decision-making responsibilities at the appropriate level.

NOTES

[1] Joint Chiefs of Staff, Joint Vision 2010, (Washington: 1996), 1.

[2] Ibid., 16.

[3] Kenneth F. McKenzie, Jr. "Beyond Luddites and Magicians: Examing the MTR," Parameters, Summer 1995, 17-18.

[4] Joint Chiefs of Staff, Expanding Joint Vision 2010: Concept for Future Operations, (Washington: May 1997), 68.

[5] Joint Chiefs of Staff, Department of Defense Dictionary of Military and Associated Terms (Joint Publication 1-02) (Washington: March 23, 1994), 78.

[6] Joint Chiefs of Staff, Expanding Joint Vision 2010, 65.

[7] Ibid., p. 66.

[8] Ibid., p. 67.

[9] Wayne F. Sweitzer, "Battlespace Information, Command and Control (C2), Operational Intelligence, and Systems Integration," Joint Military Operations Department, (Newport, RI: 1998), 1-8.

[10] Joint Chiefs of Staff, Joint Vision 2010, 16.

[11] William A. Owens, "The Emerging System of Systems," U.S. Naval Institute Proceedings, May 1995, 37.

[12] Arthur K. Cebrowski and John J. Garstka, "Network-Centric Warfare -- Its Origin and Future," U.S. Naval Institute Proceedings, January 1998, 32.

[13] Gordon R. Sullivan and James M. Dubik, "War in the Information Age," Military Review, April 1994, 60.

[14] JCS, Expanding Joint Vision 2010, 26.

[15] Sweitzer, 4.

[16] Naval Doctrine Publication (NDP) 6, Naval Command and Control, (Washington: 1995), 21-23.

[17] Sweitzer, 6.

[18] Ibid., 7.

[19] Francis Fukuyama and Abram N. Shulsky, "The Virtual Corporation" and Army Organization, (Washington: RAND, 1997), 19-22.

[20] JCS, Joint Vision 2010, 19.

[21] JCS, Expanding Joint Vision 2010, 51.

[22] Owens, 38.

[23] Ibid., 37.

[24] Ibid., 37-38.

[25] JCS, Expanding Joint Vision 2010, 49.

[26] Ibid.

[27] Ibid., 50.

[28] Cebrowski, 32.

[29] William S. Wallace, "Random Thoughts While Fighting," Unpublished Presentation, Fort Hood, TX: November, 1997.

[30] William A. Owens, quoted in John Barry, "The Battle Over Warfare," Newsweek, 5 December 1994, 27.

BIBLIOGRAPHY

Barry, John A. "The Battle Over Warfare." Newsweek, 5 December 1994, 27-28.

Cebrowski, Arthur K. and John J. Gasta, "Network-Centric Warfare -- Its Origin and Future." U.S. Naval Institute Proceedings, January 1998, 28-35.

Fukuyama, Francis and Abrm N. Shulsky, The "Virtual Corporation" and Army Organization. Washington: RAND, 1997.

McKenzie, Kenneth F., Jr., "Beyond Luddites and Magicians: Examining the MTR." Parameters, Summer 1995, 15-21.

Naval Doctrine Publication (NDP) 6, Naval Command and Control, Washington, D.C.: 1995.

Owens, William A. "The Emerging System of Systems." U.S. Naval Institute Proceedings, May 1995, 36-39.

Sullivan, Gordon R. and John M. Dubik. " War in the Information Age." Military Review, April 1994, 46-62.

Sweitzer, Wayne F. "Battlespace Information, Command and Control (C2), Operational Intelligence, and Systems Integration." Joint Military Operations Department, Newport, R.I.: 1998.

U. S. Joint Chiefs of Staff, Concept for Future Operations, Expanding Joint Vision 2010, Washington, D.C: May 1997.

U. S. Joint Chiefs of Staff, Department of Defense Dictionary of Military and Associated Terms (Joint Publication 1-02) Washington, D.C.: March 23, 1994.

U. S. Joint Chiefs of Staff, Joint Vision 2010, Washington, D.C.: 1996.

Wallace, William S., "Random Thoughts While Fighting," Unpublished Presentation, Fort Hood, TX: November 1997.